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[54] **COMBUSTION PRODUCTS DETECTOR WITH ACCELERATED TEST**

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[51] **Int. Cl.**[3] **G08B 29/00;** G08B 17/10

[52] **U.S. Cl.** **340/515;** 250/574; 340/630; 356/338

[58] **Field of Search** 340/630, 629, 514, 515, 340/516; 250/573, 574, 575, 381, 384; 356/338

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[57] **ABSTRACT**

A battery-powered photoelectric smoke detector periodically samples the air in a smoke chamber. A manually-operated test button is provided for simulating smoke to test the device. The sampling frequency is determined by a first resistance. A frequency changing circuit includes a test switch, the movable contact of which is coupled to the test button and is responsive to operation thereof for connecting it parallel with the first resistance the series combination of a diode and a second resistance for increasing the sampling frequency. Means are provided for back-biasing the diode to disable the frequency changing circuit when the detector detects smoke.

20 Claims, 4 Drawing Figures

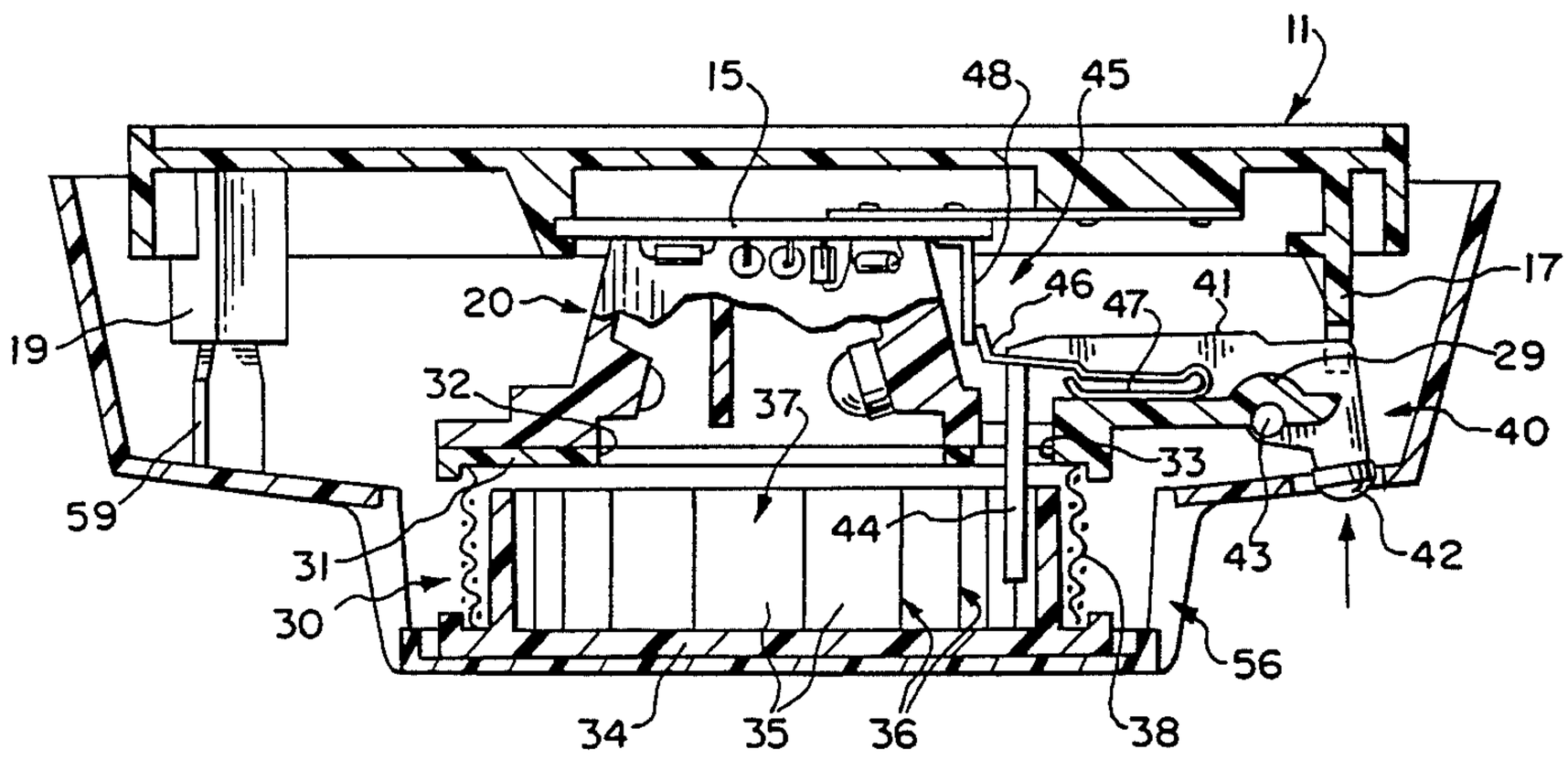


FIG. 1

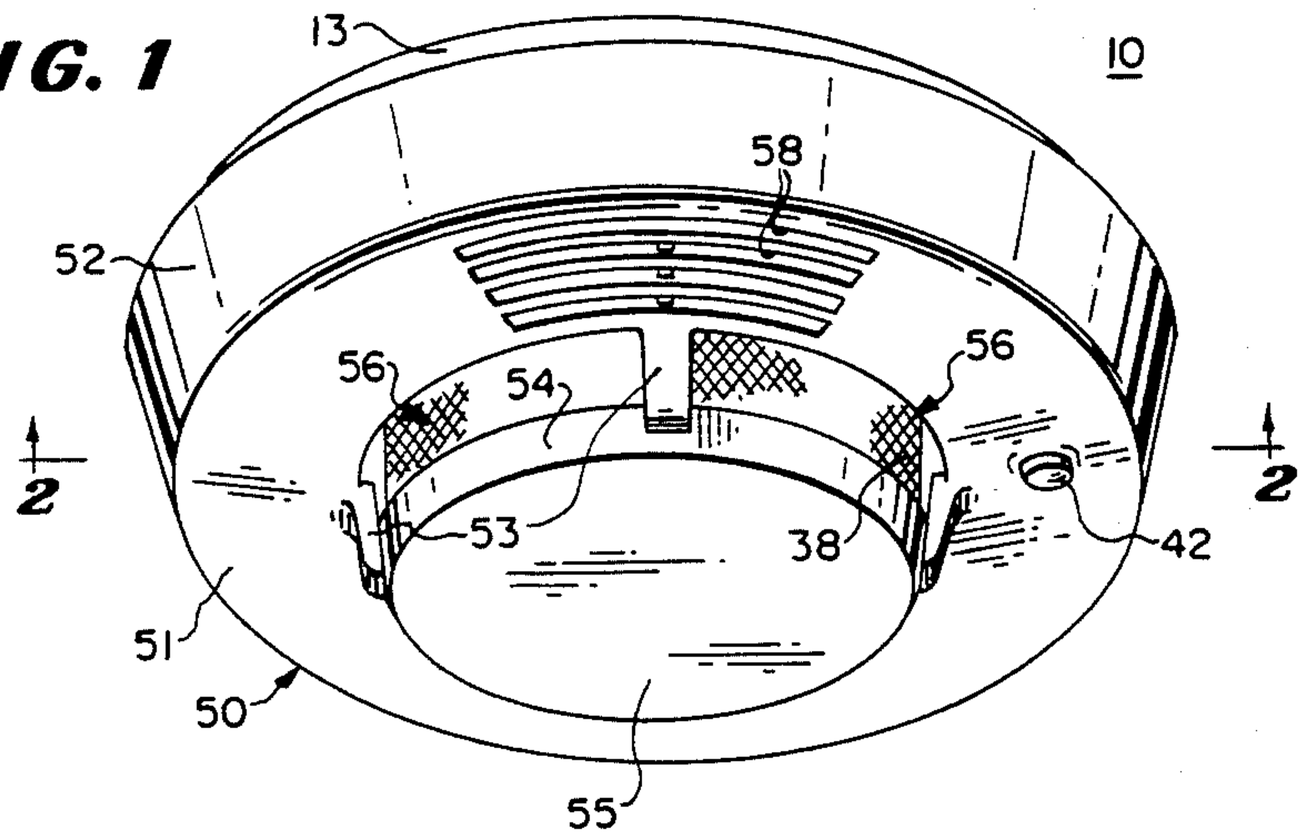


FIG. 2

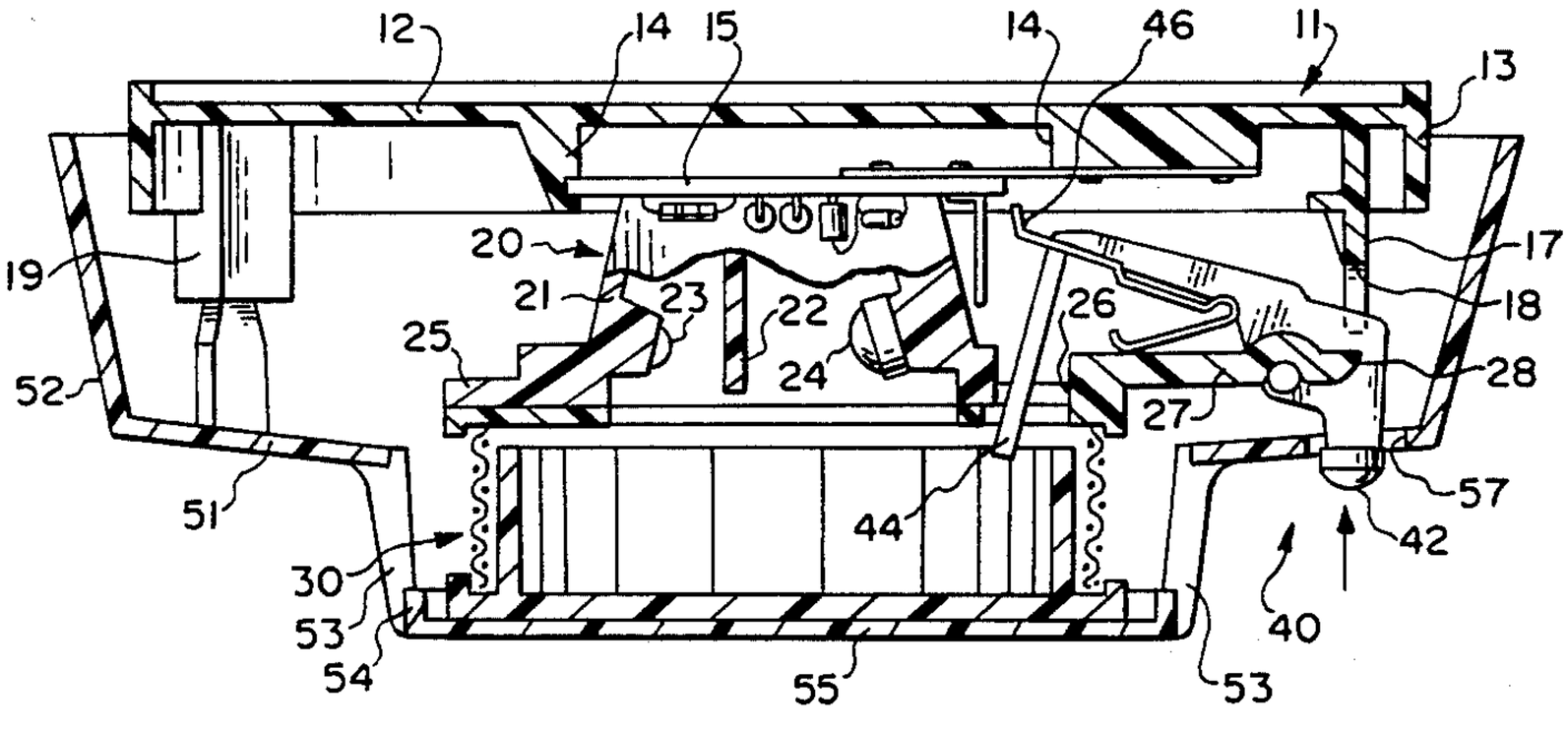
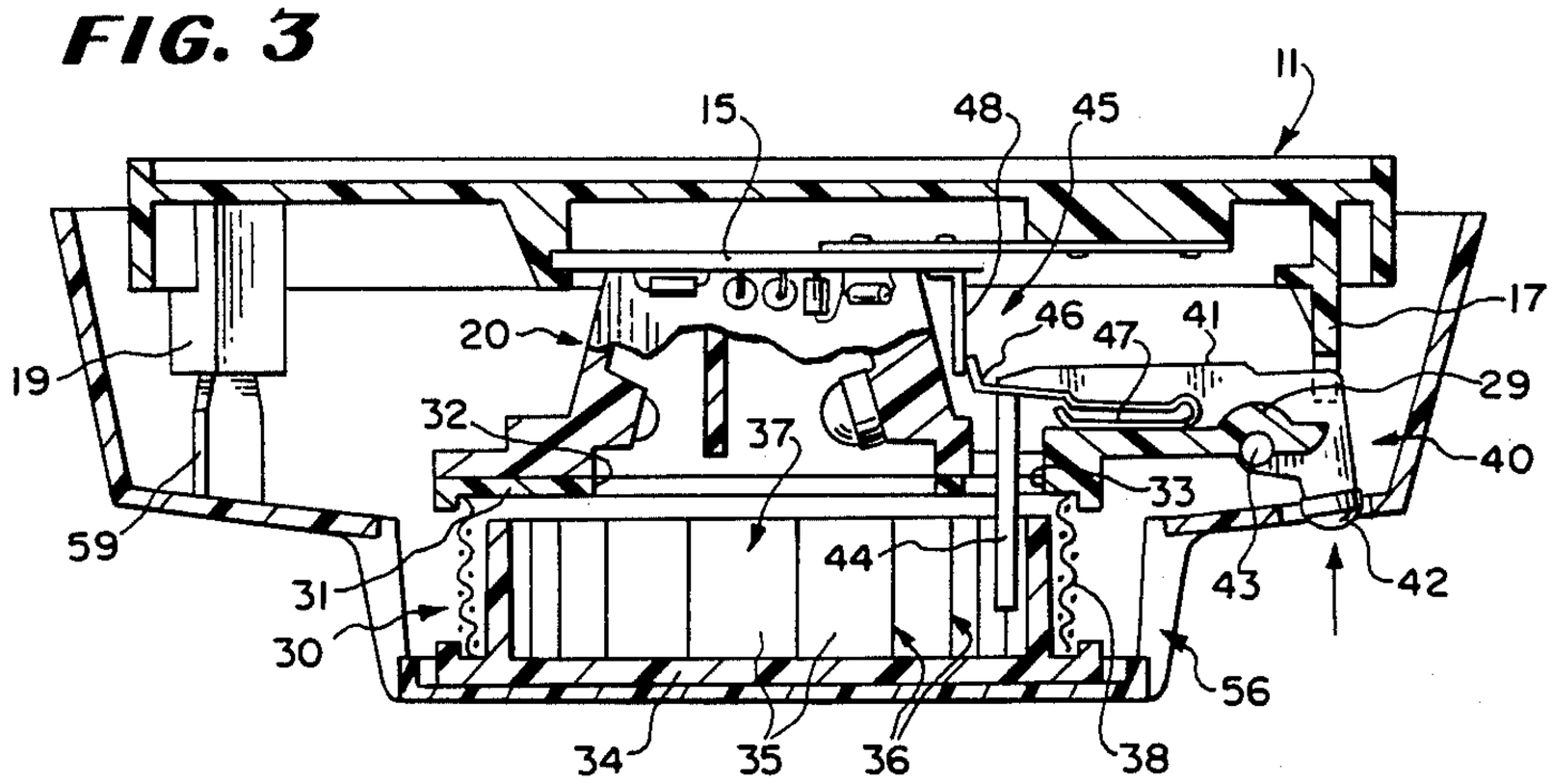
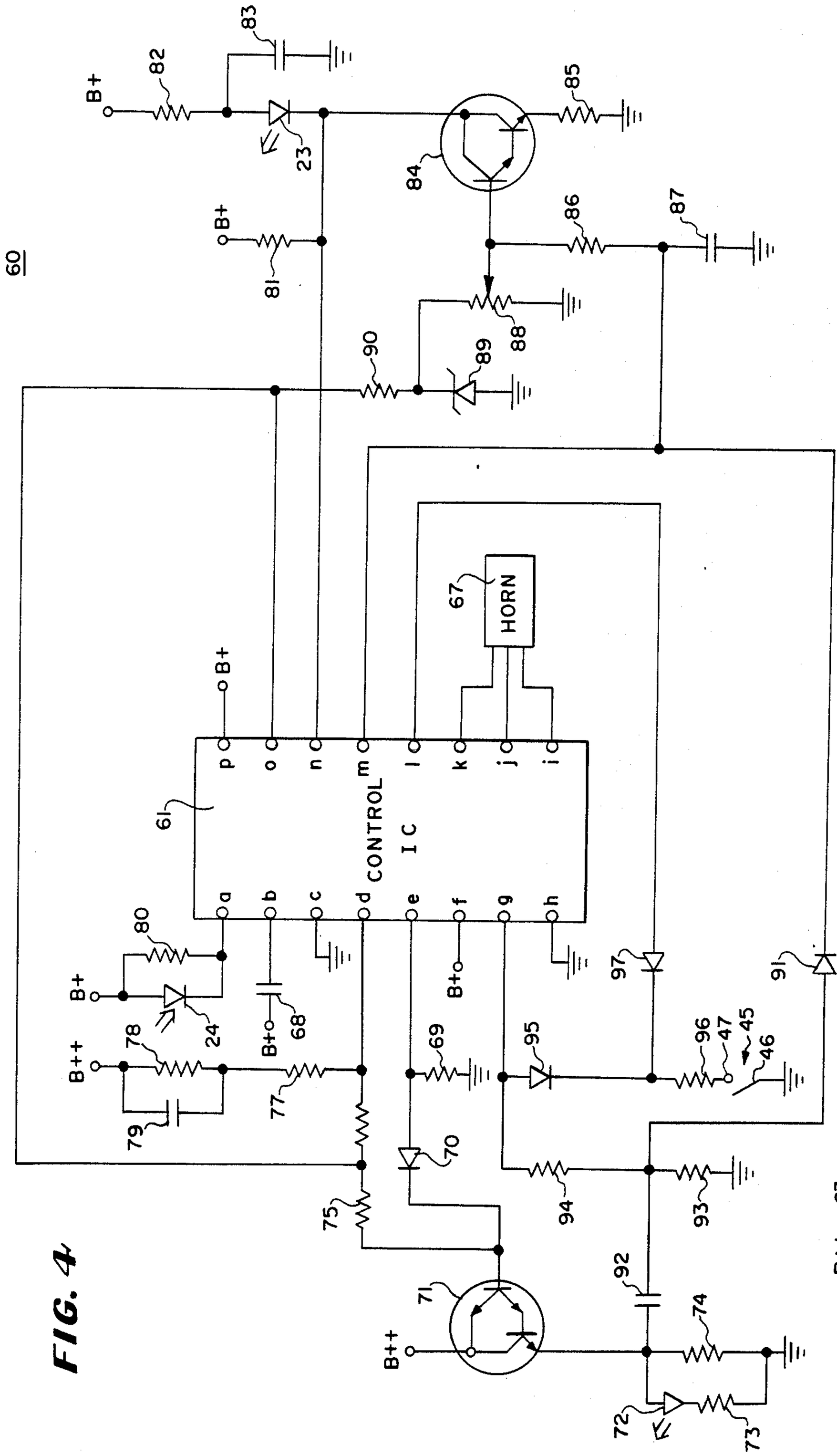


FIG. 3

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B++
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B++
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72
73
94
93

FIG. 4

COMBUSTION PRODUCTS DETECTOR WITH ACCELERATED TEST

BACKGROUND OF THE INVENTION

The present invention relates to combustion products detectors and, in particular, to combustion products detectors of the battery-powered photoelectric type. The invention relates specifically to the apparatus for testing a combustion products detector.

In order to minimize the current drain on the batteries of a battery-powered photoelectric smoke detector, the device is rendered operative to look for the presence of smoke by sampling the ambient air relatively infrequently, typically on the order of once every ten to thirty seconds. Thus, a control means is provided for periodically actuating the photoelectric sensing means for emitting a flash of light into a smoke chamber to see if any light-reflecting smoke is present. In order to test the operation of the device, it is typically provided with a manually-operated test button. The test button is connected to a reflective member which is movable into the smoke chamber for optical coupling with the photoelectric sensing means. Thus, when the reflector is inserted during test, it's reflective characteristics simulate the presence of smoke and, if the device is operating properly, the alarm signal will be sounded.

However, because the photoelectric sensing means is actuated only infrequently, the user may have to hold the test button in for as long as thirty seconds to keep the reflector in the smoke chamber until the photoelectric sensing means is actuated. This is a considerable inconvenience, particularly in view of the fact that smoke detectors are commonly located on ceilings or other relatively difficult-to-reach locations. Furthermore, because of the relatively long time that he may have to wait in order to properly perform the test function, the user may mistakenly conclude before the end of this time that the device is malfunctioning.

Photoelectric combustion products detectors commonly have a feature whereby the device must detect smoke on two or more consecutive samplings before the alarm is sounded, in order to minimize the chance of spurious or false alarms. Thus, it is known in such devices to increase the sampling rate in response to the first smoke detection, so that the subsequent smoke detections will occur more rapidly. But this does not solve the time delay problem during test, since it does not eliminate the delay before the first detection of simulated smoke.

SUMMARY OF THE INVENTION

It is a general object of the present invention to provide an improved battery-powered photoelectric combustion products detector which avoids the disadvantages of prior detectors while affording additional structural and operating advantages.

It is an important object of this invention to provide a combustion products detector of the type set forth which reduces the time for the first "smoke" detection during test of the device.

In connection with the foregoing object, it is another object of this invention to provide a combustion products detector of the type set forth, wherein the smoke sampling frequency is increased in response to operation of the test mechanism.

Still another object of this invention is the provision of a combustion products detector of the type set forth,

wherein the acceleration of the sampling frequency occurs substantially simultaneously with the operation of the test mechanism.

It is another object of this invention to provide a combustion products detector of the type set forth, wherein the test mode sampling acceleration means is disabled once "smoke" is detected.

These and other objects of the invention are attained by providing a combustion products detector including combustion products sensing means, alarm means responsive to the sensing of combustion products by the sensing means, control means for periodically enabling the sensing means and test means selectively operable for simulating the presence of combustion products, the improvement comprising: frequency change means coupled to the control means and responsive to operation of the test means for changing the frequency of enablement of the sensing means.

The invention consists of certain novel features and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the details may be made without departing from the spirit, or sacrificing any of the advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawings a preferred embodiment thereof, from an inspection of which, when considered in connection with the following description, the invention, its construction and operation, and many of its advantages should be readily understood and appreciated.

FIG. **1** is a perspective view of a combustion products detector constructed in accordance with and embodying the features of the present invention;

FIG. **2** is an enlarged view in vertical section taken generally along the line **2—2** in FIG. **1**, and illustrating the test assembly in its normal rest position;

FIG. **3** is a view similar to FIG. **2** illustrating the test assembly in its test position; and

FIG. **4** is an electrical schematic circuit diagram of the control circuitry for the combustion products detector of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. **1–3** of the drawings, there is illustrated a combustion products detector, generally designated by the numeral **10**, constructed in accordance with and embodying the features of the present invention. The combustion products detector **10** is a battery-powered, photoelectric detector which includes a base **11** adapted to be mounted on a ceiling or other suitable support surface. The base **11** has a substantially circular wall **12**, integral around the perimeter thereof with a depending cylindrical peripheral wall **13**. Integral with the circular wall **12** and depending therefrom are a plurality of mounting projections **14** adapted for supporting a printed circuit board **15**. Also integral with the circular wall **12** and depending therefrom is an elongated mounting arm **17** for a purpose to be described more fully below, the arm **17** being provided with a slot **18** in its distal end. A plurality of of hollow attachment posts **19** (one shown) are integral with the circular wall **12** at equiangularly spaced apart points

thereon and depend therefrom, each of the posts **19** having an opening in the distal end thereof.

Mounted on the circuit board **15** and depending therefrom is an optical assembly, generally designated by the numeral **20** which includes a hollow, open-bottom housing **21** defining a chamber therein, and provided with a septum **22** dividing the chamber into two separate compartments. Mounted on the housing **21**, respectively in the two compartments, are an infrared LED **23** and a photodiode **24**, both being directed generally toward the septum **22**, the dimensions of the septum **22** being such as to prevent light from the LED **23** from impinging directly on the photodiode **24**. The housing **21** is provided around the lower end thereof with a laterally outwardly extending attachment flange **25**, provided at one end thereof with an aperture **26** therethrough. The attachment flange **25** includes an elongated extension **27** which extends substantially parallel to the circular wall **12** and is provided with a clevis end **28** having a slot (not shown) formed therein. Formed in the extension **27** adjacent to the clevis end **28** is an arcuate bearing seat **29**.

Secured to the attachment flange **25** is a smoke chamber assembly, generally designated by the numeral **30**, which includes a substantially circular inner wall **31** having a circular central aperture **32** disposed substantially in registry with the open bottom of the housing **21**, and also having a peripheral aperture **33** which is disposed in registry with the aperture **26** in the attachment flange **25**. The smoke chamber assembly **30** also includes a circular outer wall **34** disposed beneath and substantially parallel to the inner wall **31** and connected thereto by suitable connecting means (not shown). Integral with the inner surface of the outer wall **34** and projecting upwardly therefrom are a plurality of spaced-apart, part-cylindrical louver plates **35** which are arranged in overlapping relationship for defining a louvered, generally cylindrical wall, which cooperates with the inner and outer walls **31** and **34** for defining a smoke chamber **37**, the spaces between the louver plates **35** defining openings **36** for providing access to the smoke chamber **37**.

The smoke chamber assembly **30** is formed of substantially non-reflective material, the louver plates **35** being so constructed and arranged as to substantially prevent the admission of ambient light into the smoke chamber **37**, while permitting the flow of combustion products thereinto through the openings **36**. A cylindrical screen **38** encircles the louver plates **35** and is trapped between the inner and outer walls **31** and **34** for screening out large particles of combustion products and for cooperating with the louver plates **35** for limiting light into the smoke chamber **37**.

In operation, because there is no direct optical path between the LED **23** and the photodiode **24**, and because the smoke chamber assembly **30** is non-reflective, light from the LED **23** cannot normally reach the photodiode **24**. However, when smoke or other combustion products are present in the smoke chamber **37**, the light from the LED **23** reflects off the particles of smoke or other combustion products, this reflected light reaching the photodiode **24** to activate it and to give an indication of smoke detection, all in a well known manner.

The combustion products detector **10** also includes a test assembly, generally designated by the numeral **40** which includes a lever **41** disposed in the slot in the clevis end **28** of the extension **27** and provided at one end thereof with a push button **42**. Projecting laterally from the lever **41** intermediate its ends is a pivot pin **43** which is rotatably supported in the arcuate bearing seat **29** for pivotal movement of the lever **41** about the axis of the pivot pin **43**. Integral with the lever **41** at its other end and depending therefrom is a substantially rectangular reflector vane **44** of light-reflective material, the reflector vane **44** having the distal end thereof disposed for insertion through the apertures **26** and **33** into the smoke chamber **37**.

The test assembly **40** includes a test switch generally designated by the numeral **45**, which includes a movable spring contact **46** which is mounted on the lever **41** and projects outwardly beyond the reflector vane **44**, the spring contact **46** having a folded leaf portion **47** which bears against the extension **27** of the housing attachment flange **25**, resiliently to hold the pivot pin **43** firmly seated in the arcuate bearing seat **29**, and resiliently urging the lever **41** toward rotation in a clockwise direction, as viewed in the drawings, to a normal rest position illustrated in FIG. **2**, wherein the reflector vane **44** is withdrawn from the smoke chamber **37**. The test switch **45** also includes a fixed contact **48** which is fixedly secured to the circuit board **15** and is spaced from the movable contact **46** when the lever **41** is in its normal rest position.

By manually pushing the button **42** upwardly in the direction of the arrow in FIGS. **2** and **3**, the lever **41** is pivoted about the axis of the pivot pin **43** in a counterclockwise direction, against the urging of the spring leaf **47**, to a test position, illustrated in FIG. **3**, wherein the movable contact **46** engages the fixed contact **48** for closing the test switch **45**, and wherein the reflector vane **44** is inserted into the smoke chamber **37** in a position for reflecting light from the LED **23** to the photodiode **24**. This movement of the lever **41** to its test position is accommodated by the slot **18** in the mounting arm **17**.

The combustion products detector **10** also includes a cover **50** which has an annular wall **51** integral around the outer perimeter thereof with an upstanding frustoconical skirt **52**, and integral around the inner edge thereof with a plurality of equiangularly spaced apart, depending webs **53**. The lower ends of the webs **53** are, in turn, integral with a cylindrical flange **54** of a circular end wall **55**, the webs **53** cooperating with the end wall **55** and with the annular wall **51** for defining a plurality of large, generally rectangular openings **56** for allowing the flow of air to and from the smoke chamber assembly **30**. The annular wall **51** has a circular aperture **57** therethrough for accommodating the button **42** of the test lever **41**, and is also provided with a plurality of arcuate slots **58**.

Integral with the annular wall **51** at equiangularly spaced apart points therealong and projecting upwardly therefrom are a plurality of attachment fingers **59** respectively disposed for insertion in the open ends of the attachment posts **19** for mounting the cover **50** on the base **11**. More particularly, the attachment posts **19** may include latch means (not shown) for holding the cover **50** in place in its mounted position illustrated in FIGS. **2** and **3**, in which position the skirt **52** overlaps the peripheral wall **13** of the base **11** for cooperation therewith to conceal the internal mechanism of the combustion products detector **10**. As illustrated in FIG. **2**, when the cover **50** is disposed in its mounted position, the test button **42** projects through the aperture **57** and extends a predetermined distance beneath the annular wall **51** for access by a user.

Referring now to FIG. 4 of the drawings, there is illustrated an electrical circuit, generally designated by the numeral **60**, for controlling the operation of the combustion products detector **10**, it being appreciated that the components of the electrical circuit **60** are mounted on the circuit board **15**. The circuit **60** includes an integrated control circuit (IC) **61** having a plurality of terminal pins a–p. The IC **61** may be a CMOS IC of the type sold by Supertex Inc. of Sunnyvale, Calif. under the designation SD-2. Power for the circuit **60** is provided by a battery **62**, the positive terminal of which is designated B++, and is preferably at +9 volts. Connected in series across the battery **62** are a resistor **63** and a capacitor **64**, a diode **65** being connected in parallel with the resistor **63**. A B+ supply is provided at the junction of the resistor **63** and the capacitor **64**. The pins i, j and k of the IC **61** are connected to an alarm horn **67**, which is preferably a piezoelectric horn of standard construction. Pin b of IC **61** is connected through a capacitor **68** to the B+ supply. Pins f and p are connected directly to the B+ supply while pins c and h are connected to ground.

Pin e of the IC **61** is connected through a resistor **69** to ground and through a diode **70** to the base of a Darlington transistor **71**, the collector of which is connected to the B++ supply. The emitter of the transistor **71** is connected in series through a visible-light LED **72** and a current-limiting resistor **73** to ground, a resistor **74** being connected in parallel with the LED **72** and the resistor **73**. The base of the transistor **71** is also connected through series resistors **75** and **76** to pin d of the IC **61**. Pin d is also connected through series resistors **77** and **78** to the B++ supply, a capacitor **79** being connected in parallel with the resistor **78**. Pin a of the IC **61** is connected to the cathode of the photodiode **24**, the anode of which is connected to the B+ supply, a resistor **80** being connected in parallel with the photodiode **24**.

Pin n of the IC **61** is connected through a resistor **81** to the B+ supply, and is also connected to the cathode of the infrared LED **23**. The anode of the LED **23** is connected through a current-limiting resistor **82** to the B+ supply, and through a capacitor **83** to ground. Pin n of the IC **61** is also connected to the collector of a Darlington transistor **84**, the emitter of which is connected through a current-limiting resistor **85** to ground. A resistor **86** and a capacitor **87** are connected in series between the base of the transistor **84** and ground. The base of the transistor **84** is also connected to the wiper of a potentiometer **88**, which is connected in series with a resistor **90** between pin o of the IC **61** and ground. A Zener diode **89** is connected in parallel with the potentiometer **88**. Pin o of the IC **61** is also connected to the junction between the resistors **75** and **76**, while pin m is connected to the junction between the resistor **86** and the capacitor **87**.

Pin m of the IC **61** is also connected to the cathode of a diode **91**, the anode of which is connected through a capacitor **92** to the emitter of the transistor **71**, and through a resistor **93** to ground. The anode of the diode **91** is also connected through a resistor **94** to pin g of the IC **61**. Connected in series between the pin g and ground are a diode **95**, a resistor **96** and the normally-open test switch **45**. The cathode of the diode **95** is connected to the cathode of a diode **97**, the anode of which is connected to pin **1** of the IC **61**.

In operation, the IC **61** has an internal oscillator, the frequency of which is controlled by the resistors **93** and **94**. The IC **61** also includes a ripple counter which divides the clock frequency, different points in the counter being picked off for different timing outputs. In normal operation, the IC **61** produces an "enable" output on pin e about once every 12 seconds, the enable output being in the form of a pulse of about 3 ms duration. This "enable" output is applied through the diode **70** to the base of the Darlington transistor **71** for turning it on to energize the LED **72**, thereby giving a visible indication that the timing circuit is operating.

At the end of each "enable" pulse, a one-shot multivibrator in the IC **61** produces about a 150-microsecond sampling pulse which appears at pin o, causing it to become high for 150 microseconds, the duration of this sampling pulse being controlled by the resistor **69** connected to pin e. This high output at pin o is coupled through the resistor **90** and the potentiometer **88** to the base of the Darlington transistor **84** for turning it on. Thus, the transistor **84** draws current through the LED **23** for 150 microseconds. More specifically, the capacitor **83** is charged during the 12-second interval between sampling pulses, and when the transistor **84** is turned on, the capacitor **83** discharges through the LED **23**, the values of the various components being such that the capacitor **83** provides about 100 to 300 ma to drive the LED **23**. The IC **61** is configured so that it can be placed into any of several different test modes during factory setup. The resistor **81** serves to maintain pin n at approximately B+ so that it cannot go into one of these factory test modes after the combustion products detector **10** is installed in the field.

The infrared flash from the LED **23** is coupled into the smoke chamber **37** and, in the presence of smoke, will cause a reflection to energize the photodiode **24** for applying an input signal to pin a of the IC **61**. The capacitor **68** serves as a memory capacitor for monitoring the electrical noise in the circuit. This effectively sets up a reference in the IC **61** against which the photodiode **24** works, so that the output signal from the photodiode **24** must exceed this reference in order for the IC **61** to register a sensing of smoke.

The circuitry connected to pin d of the IC **61** is to sense battery trouble. If the battery **62** is low or is bad (has a high resistance), this condition is reported at pin d. Resistors **76–78** set up a voltage divider input for the battery trouble circuit. Because of the high impedance of a bad battery, when the circuit attempts draw a lot of current from it, the voltage at the battery terminals drops. Thus, when the visible LED **72** is turned on for 3 ms during the "enable" pulse, it draws current from the battery **62** and, if the battery **62** has a high impedance it will produce a voltage drop that is coupled to pin d of the IC **61**.

When the IC **61** receives an input at its pin a from the photodiode **24**, indicative of a sensing of smoke, internal circuitry in the IC **61** causes the sampling rate to speed up, so that "enable" pulses at the pin e and sampling pulses at the pin n are produced about once every 1.5 seconds. The circuitry of the IC **61** is such that it must see two consecutive inputs at pin a before the system will go into alarm, to reduce the chance of false alarms. When two consecutive inputs at pin a have been received, indicating two successive smoke detections, pin m becomes high and the horn **67** is turned on through pins i, j and k. The high at pin m causes some current to be fed back through the resistor **86** to the base of transistor **84**. This provides a little more current for the LED **23**, making the unit become more sensitive.

The horn **67** has a mechanical resonance which is fed back into pins i and j and tends to desense the IC **61**. In order to alleviate this problem, the diode **91**, the capacitor **92** and the resistor **93** are provided. Thus, when the system goes into alarm, the high at pin m back-biases the diode **91**, causing the junction between the capacitor **92** and the resistor **93** to become high for a short time to turn off the clock of IC **61** at pin g, which prevents anything from happening in the IC **61**. The IC **61** is held off for about 20 or 25 ms until all of the mechanical resonance of the horn **67** has dissipated, after which the IC **61** returns to normal operation.

Pin **13** is adapted to be connected to other detectors when the detector **10** is part of a system of such detectors. This connection causes the detector **10** to go into alarm when any other detector in the system goes into alarm. When the horn **67** (or the horn of another detector in the system) is energized, it causes noise to be generated on the B+ line, impairing the sensitivity of the IC **61** and making it difficult to detect the input signal at pin a, which is typically in the range of 1 mv. Accordingly, the circuitry of the IC **61** operates to momentarily turn the horn **67** off just before each sampling pulse. The B+ connected to pin f causes the horn **67** to be modulated by internal circuitry of the IC **61** to have a duty cycle of about 80%. If pin f were at ground, the horn **67** would operate continuously.

The test operation of the combustion products detector **10** will now be explained with reference to the circuit **60**. When it is desired to test the operation of the combustion products detector **10**, the button **42** is manually depressed, thereby moving the reflector vane **44** to its test position inserted in the smoke chamber **37** and, simultaneously, closing the test switch **45**. In the absence of the test switch **45**, the user might have to wait up to 12 seconds in the preferred embodiment (or as long as 30 seconds, depending upon the predetermined normal sampling rate of the IC **61**), until the next sampling pulse is emitted at the pin n to energize the LED **23**. But closure of the test switch **45** connects the resistor **96** in parallel with the resistors **93** and **94**, through the diode **95**. This reduces the resistance seen at the pin g, thereby increasing the clock frequency so that sampling pulses are produced at the pin o about once every 2 seconds.

Thus, after the button **42** has been held in for only about 2 seconds, the first sampling pulse occurs. When this sampling pulse occurs, the LED **23** is energized, producing a 150-microsecond light flash which is reflected from the reflector vane **44** to energize the LED **23**, producing a smoke sense input at pin a of IC **61**. The input at pin a causes the sampling rate to increase by operation of the internal circuitry of the IC **61** to produce sampling pulses about once every 1.5 seconds, as described above. But this assumes that the clock is operating at its normal frequency. In order to return it to its normal frequency, the test circuitry which comprises the diode **95**, the resistor **96** and the switch **45** is disabled once a smoke sense input is received at pin a. To accomplish this, the pin **1** is coupled to the cathode of the diode **95**. Whenever there is a smoke sense input at pin a, the pin **1** becomes high and stays high until there is an absence of smoke sense input at pin a for two consecutive sampling times. This high at pin **1** back-biases the diode **95**, rendering it nonconductive and thereby eliminating the current path to ground in parallel with the resistors **93** and **94**, so that those resistors then resume control of the internal IC **61** clock, returning it to normal operation. During this normal operation, the pin g becomes alternately high and low. The diode **97** is necessary to prevent a high at the pin g from being fed back to the pin **1**.

In summary it can be seen that once the test button **42** is pushed, it need be held depressed for no more than 4 seconds in order to actuate the horn **67**, i.e., about 2 seconds for the first smoke sense input to appear at pin a, and about 1.5 seconds for the second smoke sense input to appear at pin a for activating the horn **67**. It will be appreciated, that by selection of the values of the various components of the circuit **60**, the timing of the IC **61**, during both normal operation and during test, can be changed.

From the foregoing, it can be seen that there has been provided an improved combustion products detector of the battery-powered photoelectric type, which has a speeded up alarm test operation, so as to minimize the amount of time that the test button need be held depressed to activate the alarm.

We claim:

1. In a combustion products detector including combustion products sensing means, alarm means responsive to the sensing of combustion products by the sensing means, control means for periodically enabling the sensing means and test means selectively operable for simulating the presence of combustion products, the improvement comprising: frequency change means coupled to the control means and responsive to operation of the test means for changing the frequency of enablement of the sensing means.

2. The combustion products detector of claim **1**, wherein said frequency change means operates substantially simultaneously with the operation of the test means.

3. The combustion products detector of claim **1**, and further including means for manually operating the test means.

4. The combustion products detector of claim **3**, and further including means mechanically coupling said frequency change means to the test means.

5. The combustion products detector of claim **1**, wherein said frequency change means increases the frequency of enablement of the sensing means.

6. The combustion products detector of claim **1**, wherein the sensing means is photoelectric.

7. The combustion products detector of claim **6**, wherein the test means includes reflective means movable between a normal position optically isolated from the sensing means and a test position optically coupled to the sensing means.

8. The combustion products detector of claim **1**, wherein the control means includes impedance means for determining the frequency of enablement of the sensing means, said frequency change means including means for changing the impedance of said impedance means.

9. The combustion products detector of claim **8**, wherein said frequency change means includes an impedance element and switch means operable in response to operation of the test means for connecting said impedance element to said impedance means.

10. In a combustion products detector including combustion products sensing means, alarm means responsive to the sensing of combustion products by the sensing means, control means for periodically enabling the sensing means at a low first frequency during standby and at a higher second frequency in response to sensing

of combustion products by the sensing means, and test means selectively operable for simulating the presence of combustion products, the improvement comprising: frequency change means coupled to the control means and responsive to operation of the test means for changing the frequency of enablement of the sensing means to a third frequency, and means coupled to the control means and to said frequency change means for disabling said frequency change means in response to the sensing of combustion products by the sensing means.

11. The combustion products detector of claim **10**, wherein said third frequency is between said first and second frequencies.

12. The combustion products detector of claim **10**, wherein the control means includes first impedance means for determining the first frequency of enablement of the sensing means, said frequency change means including second impedance means and switch means for connecting said second impedance means in parallel with said first impedance means in response to operation of the test means.

13. The combustion products detector of claim **12**, wherein said second impedance means includes a unidirectional current flow device, said disabling means being operative to render said unidirectional current flow device non-conductive in response to sensing of combustion products by the sensing means.

14. The combustion products detector of claim **13**, wherein said disabling means include means for preventing current flow from said frequency change means to the control means.

15. In a combustion products detector including combustion products sensing means, alarm means responsive to the sensing of combustion products by the sensing means, control means for periodically enabling the sensing means and test means selectively movable between a normal condition and a test condition for simulating the presence of combustion products, the improvement comprising: first impedance means coupled to the control means so that the frequency of enablement of the sensing means is a function of the impedance of said first impedance means, second impedance means, and switch means coupled to said first and second impedance means and to the test means and responsive to movement of the test means to its test condition for connecting said first and second impedance means in parallel.

16. The combustion products detector of claim **15**, wherein each of said first and second impedance means includes a resistor.

17. The combustion products detector of claim **15**, wherein said second impedance means includes a unidirectional current flow device, and further including means coupled to the control means and to said second impedance means for rendering said unidirectional current flow device non-conductive in response to sensing of combustion products by the sensing means.

18. The combustion products detector of claim **15**, wherein the sensing means is photoelectric, the test means including reflector means movable between a normal position isolated from the sensing means and a test position optically coupled to the sensing means.

19. The combustion products detector of claim **18**, wherein said switch means includes a movable contact mechanically coupled to said reflector means for movement simultaneous therewith to close said switch means when said reflector means is moved to its test position.

20. The combustion products detector of claim **19**, and further including bias means resiliently urging said reflector means to the normal position thereof, and means for effecting manual movement of said reflector means to the test position thereof.

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